Uncertainty in Ecological Risk Assessments

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USACHPPM's Role in Risk Assessment

- AR 200-1 authorities:
  - review authority on all HHRA's and ERA's
  - approval authority on all HHRA's and ERA's
  - set risk assessment policy
- Provide consultative services to the installations
- In-house risk assessments

ERA Guidance

- Ecological Risk Assessment for Superfund ("ERAGS"; 1997)
- Guidelines for Ecological Risk Assessment (1998)
- Tri-Service Procedural Guidelines for Ecological Risk Assessment (1996)
- Tri-Service Remedial Project Manager's Handbook for Ecological Risk Assessment (2000)
- OSWER Dir. 9285.7-28P: Ecological Risk Assessment and Risk Management Principles for Superfund Sites (1999)

The Ecological Risk Assessment Hazard Quotient (HQ)

Constructing a HQ

- just as is done in human health r.a.'s when evaluating <u>non-cancer effects</u>
- simple math; a ratio comparing "doses"

$$HQ = \frac{\textbf{estimated intake}}{\textbf{safe dose (aka NOAEL)}}$$

*units are **mg/kg/day** for both the numerator and denominator

Ecological Hazard Quotients (HQ) - quick review -

- only for birds and mammals

  (not for reptiles and amphibians)

- only for ingestion

  (not for inhalation or dermal contact)

HQ - spot quiz . . .

Question #1: A Hazard Quotient of 5 means:

a. There are 5 individuals in the population who should be demonstrating the toxicological effect
b. There is a 5% chance that individuals will be affected
c. Individuals onsite have 5 times as great a chance as those offsite of showing a toxicological effect
d. There is a one-in-five chance (i.e., 20%) that onsite receptors will be toxicologically affected

Correct Answer

e. None of the above!

Hazard quotients are not measures of risk;

they *are* **measures of levels of concern**

True or False:

Question #2.

A population with a HQ of 10 has twice as much risk as a population of the same species with a HQ of 5.

Question #3.

If a Red fox has a HQ of 10 and a Meadow vole has a HQ of 5, the Red fox is at twice the risk level of the vole.

Correct Answers

2. **False**

3. **False**

Explanation:

- first of all, HQ is not a measure of risk.
- HQs are not linearly scaled metrics

Ramifications . . .

- A HQ >1.0 does not mean that there is unacceptable risk
- A HQ >1.0 doesn’t guarantee that there is even one case of the toxicological effect to be found
- A HQ >1.0 alone should not justify a cleanup

Ramifications . . .

- **THE HQ IS ONLY A SCREENING TOOL!**

↓

- If the HQ < 1.0, site can be closed out

- If the HQ > 1.0, additional analysis (e.g., data)

  is needed

So what can I do?? (start with HQ Refinement)

- soil concentration
- body weight
- ingestion rate
- dietary composition
- Area Use Factor
- The HQ’s denominator, (i.e., the **Toxicity Reference Value; TRV**)

$$HQ = \frac{\text{estimated intake}}{\text{No Observed Adverse Effect Level (NOAEL; safe dose)}}$$

$$HQ = \frac{\text{estimated intake}}{\text{Lowest Observed Adverse Effect Level (LOAEL; effect level dose)}}$$

Example: antimony exposure to a fox (chemical intake is 0.100 mg/kg/day)

Mammalian TRV		HQ
NOAEL-based	0.025 mg/kg/day	$\frac{0.100}{0.025} = 4$
LOAEL-based	0.125 mg/kg/day	$\frac{0.100}{0.125} = 0.8$

The HQ's denominator, (i.e., the Toxicity Reference Value; TRV)

- TRV basis (NOAEL, LOAEL, other)
- Chemical form as basis of the TRV
- TRV study design
  - route-of-administration
  - test species
  - duration of study
  - toxicological endpoint of study

Beyond the HQ . . .

- spatial scale - density
- weight-of-evidence
- cost/benefit in remediating
- historical contamination/evidence of effects?

  (**remember**: your objective is risk reduction)

Spatial scale . . .

species	home range
Red fox	> 3000 acres
Mink	1900 acres
Red-tailed hawk	> 3000 acres
Marsh wren	0.13 acres
American robin	0.61 acres

Spatial scale . . .

species	density
Red fox	0.02/acre
American robin	2 pairs/acre
Marsh wren	4 males/acre
Woodcock	1.4 birds/acre

Eco Risk Options for BECs

- spatial scale - density
- weight-of-evidence
- cost/benefit in remediating
- historical contamination/evidence of effects?

  (**remember**: your objective is risk reduction)

Risk Assessment & Risk Management
What's the Difference?

Risk Assessment

- A qualitative and/or quantitative appraisal of the actual or potential impact of contaminants on plants or animals
- A process for scientifically evaluating the adverse effects of contaminants on the environment
- Establishes whether a risk is present & defines a range or magnitude of the risk; it doesn't decide what gets cleaned up

Risk Management

Risk Assessment & Risk Management
What's the Difference?

Risk Management

- Combines risk assessment results with other considerations to make & justify a response decision

- Other considerations include: tradeoffs between human & ecological concerns; ecological impacts of remedial options; costs of the alternatives; available technology; implications of existing